V. REMARKS

Entry of the Amendment is proper under 37 C.F.R. §1.116 because the Amendment: a) places the application in condition for allowance for the reasons discussed herein; b) does not raise any new issue requiring further search and/or consideration because the Amendment amplifies issues previously discussed throughout prosecution; c) does not present any additional claims without canceling a corresponding number of finally rejected claims; and d) places the application in better form for appeal, should an Appeal be necessary. The Amendment is necessary and was not earlier presented because it is made in response to arguments raised in the final rejection. The amendments to the subject claims do not incorporate any new subject matter into the claims. Thus, entry of the Amendment is respectfully requested.

Claim 1 is objected to because all of an informality. The claim is amended to obviate the objection. Withdrawal of the objection is respectfully requested.

Claims 1 and 3-5 are rejected under 35 U.S.C. 102(b) as anticipated by Hsieh (US Patent No: 5,249,123). The rejection is respectfully traversed.

Claim 1 is amended to further express the recursive computation algorithm functionally. Specifically, as shown above, the definition of "lag-behind part" is clarified. For example, the "lag-behind part" is now expressed as "the radiation detection signal for a lag-behind part left unread from said radiation detecting means within the predetermined sampling time intervals, to be read at a next reading time and added to a radiation detection signal actually read at said next reading time".

It is respectfully submitted that this amendment clarifies the difference between the reference cited and the present invention, more specifically as follows:

As shown in the reference drawing (Fig. 1), the cited reference makes an afterimage correction by adding, to an insufficiency Yk1, enclosed in a dashed line, left unread from the radiation detector during a sampling period, a radiation detection signal Yk1' corresponding to the insufficiency Yk1. See Reference Drawing Figs. 1 and 2 attached.

On the other hand, the present invention subtracts a radiation detection signal left unread within a predetermined sampling period, and added superfluously as a radiation detection signal for a lag-behind part at a next sampling time.

As shown in the reference drawing (Fig. 2), an unnecessary radiation detection signal Yk0 superfluously added when a radiation detection signal Xkl is acquired, is subtracted and removed from total radiation detection signals.

Thus, the cited reference and the present invention are different in the recursive computation algorithm. It is respectfully submitted that the rejection is improper because the applied art fails to teach each element of claim 1 as now amended and discussed above. As a result, it is respectfully submitted that claim 1 is allowable over the applied art.

Claims 3-5 depend from claim 1 and include all of the features of claim 1. Thus, it is respectfully submitted that the dependent claims are allowable at least for the reason claim 1 is allowable as well as for the features they recite.

Claim 6 is rejected under 35 U.S.C. 103(a) as unpatentable over Hsieh as applied to claim 1 and further in view of Roos et al. (U.S. Patent No: 6,041,097). The Examiner believes that all of the features of these claims are either taught or suggested in the combination of these references.

Roos discloses a diagnostic imaging apparatus. The Examiner cites this reference to show a flat panel detector with improved spatial resolution.

As discussed above, it is respectfully submitted that claim 1, as amended, is allowable over Hsieh. Roos fails to cure the deficiencies Hsieh. Therefore, claim 1 is allowable over the combination of these references.

Claim 6 depends from claim 1 and includes all of the features of claim 1. Thus, it is respectfully submitted that claim 6 is allowable at least for the reason claim 1 is allowable as well as for the features it recites.

Claims 1, 2 and 6 are provisionally rejected under the judicially created doctrine of obviousness-type double patent as unpatentable over claims 1, 14 and 15 of copending application number 10/853,357 (our file no. SUT-0236). The rejection is respectfully traversed.

In determining double patenting, the issue is whether any claim of the application defines merely an obvious variation of an invention **claimed** in the earlier patent or application. It does not prohibit a later claiming of subject matter that is disclosed but not claimed in the earlier patent or application. Double patenting is concerned with attempts to "claim" related subject matter twice. In re Gibbs, 437 F.2d 486, 168 USPQ 578 (CCPA 1971). The issue in addressing the judicially created doctrine of obviousness-type double patenting is whether any claim of the application defines merely an obvious variation of the invention claimed in the earlier patent.

Claim 1 of application number 10/853,357 recites a radiographic apparatus having radiation emitting means for emitting radiation toward an object under examination, radiation detecting means for detecting radiation transmitted through the object under examination, and signal sampling means for taking radiation detection signals from the radiation detecting means at predetermined sampling time intervals, for obtaining radiographic images based on the radiation detection signals outputted from the radiation detecting means at the predetermined sampling time intervals as radiation is emitted to the object under examination. Claim 15 recites equations A-C of claim 1, as amended, of the subject application.

It is respectfully submitted that the rejection because the claims 1, 2 and 6 of the subject application fail to teach or suggest the features of claim 1 as now amended.

Withdrawal of the rejection is respectfully requested.

Claims 1, 2 and 6 are provisionally rejected under the judicially created doctrine of obviousness-type double patent as unpatentable over claims 1, 2, 4, 10 and 11 of copending application number 10/885,634 (our file no. SUT-0240). The rejection is respectfully traversed.

Claims 1, 2, 4, 10 and 11 of copending application number 10/885,634 recite:

1. A radiographic apparatus

having radiation emitting means for emitting radiation toward an object under examination, radiation detecting means for detecting radiation transmitted through the object under examination, and signal sampling means for taking radiation detection signals from the radiation detecting means at predetermined sampling time intervals, for obtaining radiographic images based on the radiation detection signals outputted from the radiation detecting means at the predetermined sampling time intervals as radiation is emitted to the object under examination, said apparatus comprising:

time lag removing means for removing lag-behind parts from the radiation detection signals by a recursive computation, on an assumption that a lag-behind part included in each of said radiation detection signals taken at the predetermined sampling time intervals is due to an impulse response formed of a plurality of exponential functions with different attenuation time constants;

wherein said time lag removing means is arranged to determine said impulse response based on a dose of radiation, and obtain a corrected radiation detection signal by removing the lag-behind part based on said impulse response corresponding to said dose.

2. A radiographic apparatus as defined in claim 1, wherein said time lag removing means is arranged to perform the recursive computation for removing the lag-behind part from each of the radiation detection signals, based on the following equations A-E:

$$\begin{aligned}
X_k = Y_k - \{ & \\
& \textstyle\sum_{n[1]=1}^{N[1]} [\alpha_{n[1]} \cdot [1-\exp(T_{n[1]})] \cdot \exp(T_{n[1]}) \cdot S_{n[1]k}] \\
& + \textstyle\sum_{n[2]=1}^{N[2]} [\alpha_{n[2]} \cdot [1-\exp(T_{n[2]})] \cdot \exp(T_{n[2]}) \cdot S_{n[2]k}] \\
& + \ldots \\
& + \textstyle\sum_{n[h]=1}^{N[h]} [\alpha_{n[h]} \cdot [1-\exp(T_{n[h]})] \cdot \exp(T_{n[h]}) \cdot S_{n[h]k}] \\
& + \ldots \\
& + \textstyle\sum_{n[H]=1}^{N[H]} [\alpha_{n[H]} \cdot [1-\exp(T_{n[H]})] \cdot \exp(T_{n[H]}) \cdot S_{n[H]k}] \\
& \} \\
& = Y_k - \{U_{n[1]} + U_{n[2]} + \ldots + U_{n[h]} \ldots + U_{n[H]}\} \\
& = Y_k - \textstyle\sum_{h=1}^{H} [U_{n[h]}] \qquad \ldots \text{A}
\end{aligned}$$

$$T_{n[h]} = -\Delta t / \tau_{n[h]} \qquad \ldots \text{B}$$

$$S_{n[j]k} = X_{k-1} + \exp(T_{n[j]}) \cdot S_{n[j]k-1} \text{ (in time of } j=h) \quad \ldots C$$
$$S_{n[j]k} = \exp(T_{n[j]}) \cdot S_{n[j]k-1} \text{ (in time of } j \neq h) \ldots D$$
$$U_{n[h]} = \sum_{n[h]=1}^{N[h]} [\alpha_{n[h]} \cdot [1-\exp(T_{n[h]})] \cdot \exp(T_{n[h]}) \cdot S_{n[h]k}] \quad \ldots E$$

where Δt: the sampling time interval;

k: a subscript representing a k-th point of time in a sampling time series;

Y_k: an X-ray detection signal taken at the k-th sampling time;

X_k: a corrected X-ray detection signal with a lag-behind part removed from the signal Y_k;

X_{k-1}: a signal X_k taken at a preceding point of time;

$S_{n(k-1)}$: an S_{nk} at a preceding point of time;

exp: an exponential function;

H: type of dose;

h: condition of a dose at a current point of time among H doses;

j: a subscript representing a given dose among the H doses;

N[h]: the number of exponential functions with different time constants forming the impulse response in time of dose h;

n[h]: a subscript representing one of the exponential functions forming the impulse response in time of dose h;

$U_{n[h]}$: a time lag in time of dose h;

$\alpha_{n[h]}$: an intensity of exponential function n; and

$\tau_{n[h]}$: an attenuation time constant of exponential function n;

and obtain the corrected radiation detection signal by removing the lag-behind part based on said impulse response derived from said equations A-E.

4. A radiographic apparatus as defined in claim 1, wherein said radiation detecting means is a flat panel X-ray detector having numerous X-ray detecting elements arranged longitudinally and transversely on an X-ray detecting surface.

10. A radiation detection signal processing method for taking, at predetermined sampling time intervals, radiation detection signals generated by irradiating an object under examination, and performing a signal processing to obtain radiographic images based on the radiation detection signals outputted at the predetermined sampling time intervals, said method comprising the steps of:

removing lag-behind parts from the radiation detection signals by a recursive computation, on an assumption that a lag-behind part included in each of said radiation detection signals taken at the predetermined sampling time intervals is due to an impulse response formed of a plurality of exponential functions with different attenuation time constants;

determining said impulse response based on a dose of radiation; and

obtaining a corrected radiation detection signal by removing the lag-behind part based on said impulse response corresponding to said dose.

11. A radiation detection signal processing method as defined in claim 10, wherein the recursive computation is performed for removing the lag-behind part from each of the radiation detection signals, based on the following equations A-E:

$$
\begin{aligned}
X_k = Y_k - \{ & \\
& \textstyle\sum_{n[1]=1}^{N[1]} [\alpha_{n[1]} \bullet [1-\exp(T_{n[1]})] \bullet \exp(T_{n[1]}) \bullet S_{n[1]k}] \\
& + \textstyle\sum_{n[2]=1}^{N[2]} [\alpha_{n[2]} \bullet [1-\exp(T_{n[2]})] \bullet \exp(T_{n[2]}) \bullet S_{n[2]k}] \\
& + \dots \\
& + \textstyle\sum_{n[h]=1}^{N[h]} [\alpha_{n[h]} \bullet [1-\exp(T_{n[h]})] \bullet \exp(T_{n[h]}) \bullet S_{n[h]k}] \\
& + \dots \\
& + \textstyle\sum_{n[H]=1}^{N[H]} [\alpha_{n[H]} \bullet [1-\exp(T_{n[H]})] \bullet \exp(T_{n[H]}) \bullet S_{n[H]k}] \\
& \} \\
& = Y_k - \{U_{n[1]} + U_{n[2]} + \dots + U_{n[h]} \dots + U_{n[H]}\} \\
& = Y_k - \textstyle\sum_{h=1}^{H} [U_{n[h]}] \qquad \dots A
\end{aligned}
$$

$$T_{n[h]} = -\Delta t / \tau_{n[h]} \qquad \dots B$$

$S_{n[j]k} = X_{k-1} + \exp(T_{n[j]}) \cdot S_{n[j]k-1}$ (in time of j=h) ... C
$S_{n[j]k} = \exp(T_{n[j]}) \cdot S_{n[j]k-1}$ (in time of $j \neq h$) ... D
$U_{n[h]} = \sum_{n[h]=1}^{N[h]} [\alpha_{n[h]} \cdot [1-\exp(T_{n[h]})] \cdot \exp(T_{n[h]}) \cdot S_{n[h]k}]$
... E

where Δt: the sampling time interval;

k: a subscript representing a k-th point of time in a sampling time series;

Y_k: an X-ray detection signal taken at the k-th sampling time;

X_k: a corrected X-ray detection signal with a lag-behind part removed from the signal Y_k;

X_{k-1}: a signal X_k taken at a preceding point of time;

$S_{n(k-1)}$: an S_{nk} at a preceding point of time;

exp: an exponential function;

H: type of dose;

h: condition of a dose at a current point of time among H doses;

j: a subscript representing a given dose among the H doses;

N[h]: the number of exponential functions with different time constants forming the impulse response in time of dose h;

n[h]: a subscript representing one of the exponential functions forming the impulse response in time of dose h;

$U_{n[h]}$: a time lag in time of dose h;

$\alpha_{n[h]}$: an intensity of exponential function n; and

$\tau_{n[h]}$: an attenuation time constant of exponential function n;

and the corrected radiation detection signal is obtained by removing the lag-behind part based on said impulse response derived from said equations A-E.

It is respectfully submitted that the rejection because the claims 1, 2 and 6 of the subject application fail to teach or suggest the features of claim 1 as now amended.

Withdrawal of the rejection is respectfully requested.

Claims 1, 2 and 6 are provisionally rejected under the judicially created doctrine of obviousness-type double patent as unpatentable over claims 1, 2 and 5 of copending application number 10/887,920 (our file no. SUT-0242). The rejection is respectfully traversed.

Claims 1, 2 and 5 of copending application number 10/887,920 recite:

1. A radiographic apparatus having radiation emitting means for emitting radiation toward an object under examination, radiation detecting means for detecting radiation transmitted through the object under examination, and signal sampling means for taking radiation detection signals from the radiation detecting means at predetermined sampling time intervals, to obtain a live image and a mask image based on the radiation detection signals outputted from the radiation detecting means at the predetermined sampling time intervals as radiation is emitted to the object under examination, the live image and the mask image being subjected to a subtraction process to obtain a subtraction image, said apparatus comprising:

time lag removing means for removing lag-behind parts from the radiation detection signals by a recursive computation, on an assumption that a lag-behind part included in each of said radiation detection signals taken at the predetermined sampling time intervals is due to an impulse response formed of one exponential function or a plurality of exponential functions with different attenuation time constants;

wherein, in order to pick up the live image and the mask image continually, the radiation detection signals relating to the live image and the radiation detection signals relating to the mask image are continually detected at the sampling time intervals, the lag-behind parts being removed from the radiation detection signals by said time lag removing means to obtain corrected radiation detection signals for forming the live image and the mask image, and obtaining the subtraction image.

2. A radiographic apparatus as defined in claim 1, wherein said time lag removing means is arranged to perform the recursive computation for removing the lag-behind part from each of the radiation detection signals, based on the following equations A-C:

$$X_k = Y_k - \sum_{n=1}^{N} \{\alpha_n \cdot [1-\exp(T_n)] \cdot \exp(T_n) \cdot S_{nk}\} \quad \ldots A$$

$$T_n = -\Delta t / \tau_n \quad \ldots B$$

$$S_{nk} = X_{k-1} + \exp(T_n) \cdot S_{n(k-1)} \quad \ldots C$$

where Δt: the sampling time interval;

k: a subscript representing a k-th point of time in a sampling time series;

Y_k: a radiation detection signal taken at the k-th sampling time;

X_k: a corrected radiation detection signal with a lag-behind part removed from the signal Y_k;

X_{k-1}: a signal X_k taken at a preceding point of time;

$S_{n(k-1)}$: an S_{nk} at a preceding point of time;

exp: an exponential function;

N: the number of exponential functions with different time constants forming the impulse response;

n: a subscript representing one of the exponential functions forming the impulse response;

α_n: an intensity of exponential function n; and

τ_n: an attenuation time constant of exponential function n.

5. A radiographic apparatus as defined in claim 1, wherein said radiation detecting means is a flat panel X-ray detector having numerous X-ray detecting elements arranged longitudinally and transversely on an X-ray detecting surface.

It is respectfully submitted that the rejection because the claims 1, 2 and 6 of the subject application fail to teach or suggest the features of claim 1 as now amended.

Withdrawal of the rejection is respectfully requested.

Claims 1, 2 and 6 are provisionally rejected under the judicially created doctrine of obviousness-type double patent as unpatentable over claims 1, 5 and 6 of copending application number 10/887,920. We propose to traverse the rejection because the claims 1, 2 and 6 of the subject application fails to teach or suggest (our file no. SUT-0245). The Examiner asserts that although the conflicting claims are not identical, they are also not patently distinct from each other.

Claims 1, 5 and 6 of copending application number 10/901,212 recite:

1. A radiographic apparatus having radiation emitting means for emitting radiation toward an object under examination, radiation detecting means for detecting radiation transmitted through the object under examination, and signal sampling means for taking radiation detection signals from the radiation detecting means at predetermined sampling time intervals, to obtain a live image and a mask image based on the radiation detection signals outputted from the radiation detecting means at the predetermined sampling time intervals as radiation is emitted to the object under examination, the live image and the mask image being subjected to a subtraction process to obtain a subtraction image, said apparatus comprising:

time lag removing means for removing lag-behind parts from the radiation detection signals by a recursive computation, on an assumption that a lag-behind part included in each of said radiation detection signals taken at the predetermined sampling time intervals is due to an impulse response formed of one exponential function or a plurality of exponential functions with different attenuation time constants;

wherein, in order to pick up the live image and the mask image continually, the radiation detection signals relating to the live image and the radiation detection signals relating to the mask image are continually detected at the sampling time intervals, the lag-behind parts being removed from the radiation detection signals by said time lag removing means to

obtain corrected radiation detection signals for forming the live image and the mask image, and obtaining the subtraction image.

5. A radiographic apparatus as defined in claim 1, wherein said radiation detecting means is a flat panel X-ray detector having numerous X-ray detecting elements arranged longitudinally and transversely on an X-ray detecting surface.

6. A radiographic apparatus as defined in claim 1, wherein said apparatus is a medical apparatus.

It is respectfully submitted that the rejection because the claims 1, 2 and 6 of the subject application fail to teach or suggest the features of claim 1 as now amended.

Withdrawal of the rejection is respectfully requested.

Claims 1, 2 and 6 are provisionally rejected under the judicially created doctrine of obviousness-type double patent as unpatentable over claims 1, 3 and 8 of copending application number 10/958,297 (our file no. SUT-0253). The Examiner asserts that although the conflicting claims are not identical, they are also not patently distinct from each other.

Claims 1, 3 and 8 of copending application number 10/958,297 recite:

1. A radiographic apparatus having radiation emitting means for emitting radiation toward an object under examination, radiation detecting means for detecting radiation transmitted through the object under examination, and signal sampling means for taking radiation detection signals from the radiation detecting means at predetermined sampling time intervals, for obtaining radiographic images based on the radiation detection signals outputted from the radiation detecting means at the predetermined sampling time intervals as radiation is emitted to the object under examination, said apparatus comprising:

time lag removing means for removing lag-behind parts from

the radiation detection signals by a recursive computation, on an assumption that a lag-behind part included in each of said radiation detection signals taken at the predetermined sampling time intervals is due to an impulse response formed of a single exponential function or a plurality of exponential functions with different attenuation time constants;

response coefficient to dose relationship storage means for storing, in advance, a relationship of correspondence between impulse response coefficients, which determine conditions relating to the impulse response in the recursive computation performed by said time lag removing means, and radiation doses; and

impulse response coefficient setting means for setting an impulse response coefficient corresponding to a radiation dose for the object under examination based on the relationship of correspondence between impulse response coefficients and radiation doses stored in the response coefficient to dose relationship storage means;

wherein said time lag removing means is arranged to obtain corrected radiation detection signals by performing the recursive computation based on the impulse response coefficient set by the impulse response coefficient setting means, to remove the lag-behind parts from the radiation detection signals.

3. A radiographic apparatus as defined in claim 1, wherein said time lag removing means is arranged to perform the recursive computation for removing the lag-behind part from each of the radiation detection signals, based on the following equations A-C:

$$X_k = Y_k - \sum_{n=1}^{N} \{\alpha_n \cdot [1-\exp(T_n)] \cdot \exp(T_n) \cdot S_{nk}\} \quad \ldots A$$

$$T_n = -\Delta t / \tau_n \quad \ldots B$$

$$S_{nk} = X_{k-1} + \exp(T_n) \cdot S_{n(k-1)} \quad \ldots C$$

where Δt: the sampling time interval;

k: a subscript representing a k-th point of time in a sampling time

series;

Y_k: an X-ray detection signal taken at the k-th sampling time;

X_k: a corrected X-ray detection signal with a lag-behind part removed from the signal Y_k;

X_{k-1}: a signal X_k taken at a preceding point of time;

$S_{n(k-1)}$: an S_{nk} at a preceding point of time;

exp: an exponential function;

N: the number of exponential functions with different time constants forming the impulse response;

n: a subscript representing one of the exponential functions forming the impulse response;

α_n: an intensity of exponential function n; and

τ_n: an attenuation time constant of exponential function n; and

when k=0, X_0=0 and S_{n0}=0.

8. A radiographic apparatus as defined in claim 1, wherein said radiation detecting means is a flat panel X-ray detector having numerous X-ray detecting elements arranged longitudinally and transversely on an X-ray detecting surface.

It is respectfully submitted that the rejection because the claims 1, 2 and 6 of the subject application fail to teach or suggest the features of claim 1 as now amended.

Withdrawal of the rejection is respectfully requested.

Further, the United States Patent and Trademark Office must establish a *prima facie* case of obviousness-type double-patenting or the rejection, if applied, will be reversed by the Board of Patent Appeals.

The Examiner is obligated to clearly set forth the basis of an obviousness-type double-patenting rejection. Under MPEP 804 II. B. 1., it states:

> Any obviousness-type double patenting rejection should make clear:

(A) The differences between the inventions defined in the conflicting claims--a claim in the patent compared to a claim in the application; and

(B) The reasons why a person of ordinary skill in the art would conclude that the invention defined in the claim in issue is an obvious variation of the invention defined in a claim in the patent.

It is respectfully submitted that the rejection is also improper because the Examiner fails to make clear the obviousness-type double patenting rejection, particularly subparagraphs (A) and (B) above. As a result, it is respectfully submitted that the Examiner fails to establish a *prima facie* case of obviousness-type double patenting.

Withdrawal of the rejection is respectfully requested.

In view of the foregoing, reconsideration of the application and allowance of the pending claims are respectfully requested. Should the Examiner believe anything further is desirable in order to place the application in even better condition for allowance, the Examiner is invited to contact Applicants' representative at the telephone number listed below.

Should additional fees be necessary in connection with the filing of this paper or if a Petition for Extension of Time is required for timely acceptance of the same, the Commissioner is hereby authorized to charge Deposit Account No. 18-0013 for any such fees and Applicant(s) hereby petition for such extension of time.

Respectfully submitted,

Date: February 16, 2006

By: ______________________

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Enclosure(s): Amendment Transmittal
Reference Drawing Figs. 1 and 2

DC223686.DOC